ORIGINAL CLINICAL RESEARCH REPORT

Association Between Dexmedetomidine Use and Duration of Invasive Mechanical Ventilation After Cardiac Surgery: A Hospital Registry Study

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BACKGROUND: Dexmedetomidine is commonly used for sedation after cardiac surgery, but its role in facilitating weaning from mechanical ventilation remains unclear, with the existing evidence yielding inconsistent findings. In this study, we hypothesized that dexmedetomidine administration is associated with a prolonged duration of mechanical ventilation after cardiac surgery.

METHODS: We conducted a retrospective cohort study of adult patients who underwent nonemergent cardiac surgery under cardiopulmonary bypass at Montefiore Medical Center, Bronx, New York, between May 2016 and June 2021. The primary exposure was the use of dexmedetomidine infusion compared to no dexmedetomidine infusion. The secondary exposure was the average, total sedative dose patients received during mechanical ventilation. The sedative dose was categorized into low and high exposure groups for analysis. Adjusted differences between groups were calculated using geometric means to enhance the interpretability of the findings.

RESULTS: Data from 2191 cases were analyzed, including 1455 (66.4%) patients who underwent coronary artery bypass graft surgeries (CABG), 521 (23.8%) valve surgeries, and 215 (9.8%) combined CABG and valve surgeries. The median (interquartile range) duration of mechanical ventilation was 406 (297–837) minutes. Dexmedetomidine infusion was associated with a longer duration of mechanical ventilation (adjusted absolute difference [ADadj] 42 minutes; 95% confidence interval [CI], 11–75; adjusted model estimates [MEadj] 1.1; 95% CI, 1.0–1.2; P = .007) compared with no dexmedetomidine administration. High sedative dose, compared to low sedative dose, was independently associated with prolonged mechanical ventilation (ADadj 71 minutes; 95% CI, 42–101; MEadj 1.2; 95% CI, 1.1–1.2; P < .001). Furthermore, the sedative dose significantly modified the association between dexmedetomidine use and ventilation duration (P for interaction <.001). Among patients with a high sedative dose, dexmedetomidine was associated with shorter mechanical ventilation (ADadj −233 minutes; 95% CI, −324 to −125; MEadj 0.7; 95% CI, 0.6–0.8; P < .001).

CONCLUSIONS: Dexmedetomidine use, and a high sedative dose during mechanical ventilation were independently associated with prolonged mechanical ventilation after cardiac surgery. Among patients with a high sedative dose, dexmedetomidine was associated with shorter mechanical ventilation duration. (Anesth Analg 2026;142:518–524)

KEY POINTS

- **Question:** Does dexmedetomidine administration affect time to extubation after cardiac surgery?
- **Findings:** Dexmedetomidine use was associated with longer mechanical ventilation duration. By contrast, in patients who received a high sedative dose, dexmedetomidine was associated with a shorter duration of mechanical ventilation.
- **Meaning:** The effect of dexmedetomidine on the duration of mechanical ventilation after cardiac surgery appears to depend on the sedative dose given during mechanical ventilation.

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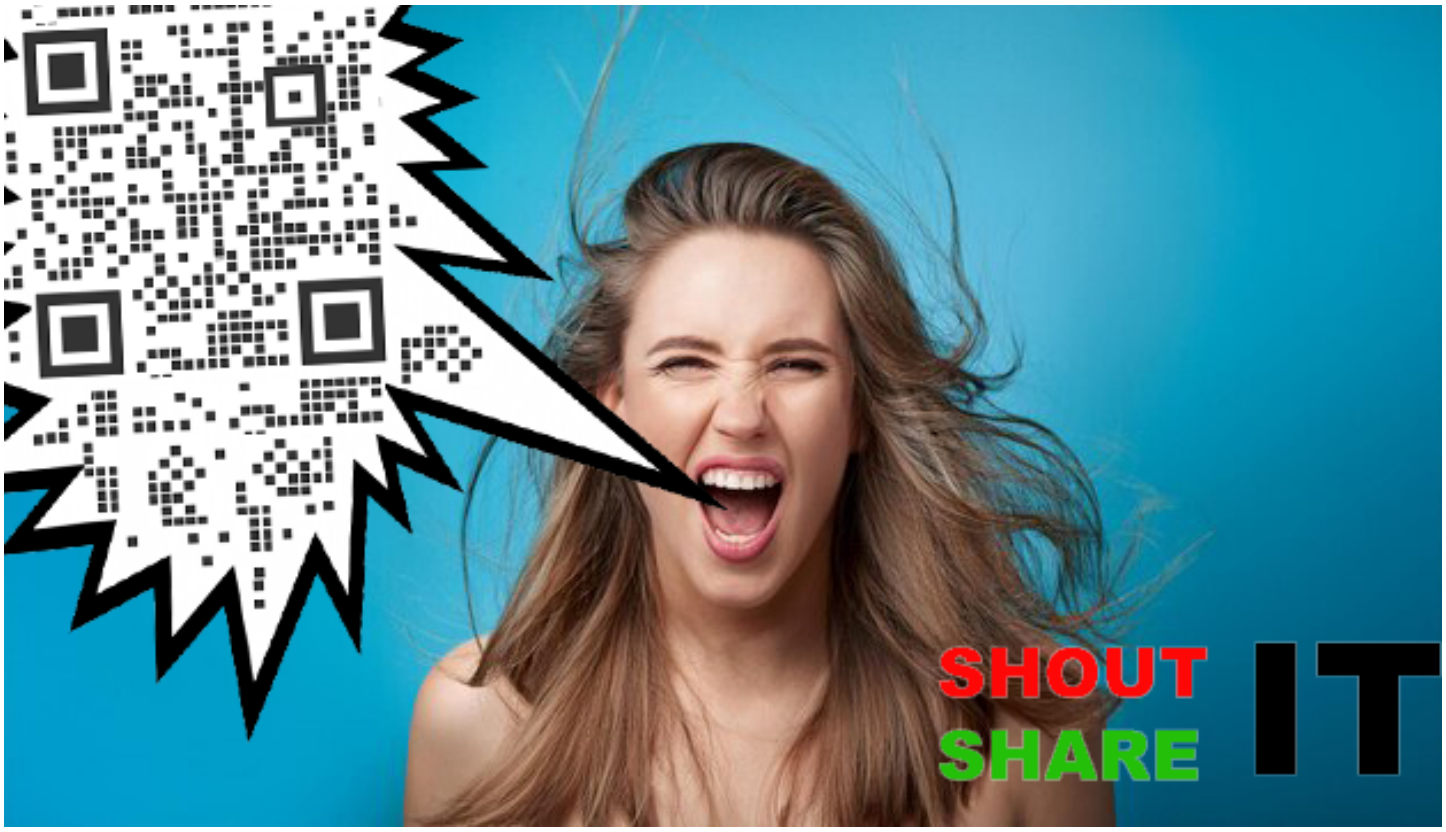
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The concept of "fast-track" care in cardiac surgery refers to a systematic, multidisciplinary approach designed to optimize postoperative recovery. A key component of this strategy is the minimization of invasive mechanical ventilation duration, coupled with early ambulation and expedited transition through the intensive care unit (ICU) to home discharge.[1,2] This approach has been linked to improved patient outcomes, including higher satisfaction rates, as well as substantial reduction in hospital costs, ICU length of stay, and duration of hospitalization.[3–5]

Dexmedetomidine is an alpha-2 adrenoceptor agonist with a half-life of over 2 hours.[6] A recent Italian consensus statement recommended incorporating dexmedetomidine to achieve fast-track recovery after cardiac surgery protocols.[7] However, it takes a long time to achieve a steady-state level, which often spans nearly an entire ICU shift.[6] There are equivocal results on the effects of dexmedetomidine on the weaning success of mechanically ventilated patients.[8,9] These discrepancies likely stem from variations in dosing strategies and administration methods, underscoring a critical gap in our understanding of the optimal use of dexmedetomidine.

In this study, we hypothesized that dexmedetomidine administration is associated with a prolonged duration of mechanical ventilation after cardiac surgery.[6]

METHODS

Study Design and Setting

We performed a retrospective cohort study of adult cardiac surgical patients at Montefiore Medical Center, a quaternary care academic medical center in the Bronx, NY. Institutional Review Board (IRB) approval was obtained under protocol number 2024–15907, with a waiver for informed consent. Clinical data were extracted from Epic electronic health system (Epic Systems) using structured queries within Epic's Clarity electronic data warehouse. (Supplemental Digital Content 1, S1.1 Data Collection, http://links.lww.com/AA/F483) The statistical plan (Supplemental Digital Content 2, Appendix 1: The Statistical Analysis Plan, https://links.lww.com/AA/F413) was written, date-stamped (permanent dated electronic signature), and recorded in the investigators' files before data were accessed. The study design and reporting adhere to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[10] (Supplemental Digital Content 1, Table S1, http://links.lww.com/AA/F483).

Study Population

The study population comprised adult patients (≥ 18 years old) who underwent nonemergent coronary artery bypass graft (CABG), valve surgery, or combined CABG-valve cardiac procedures under cardiopulmonary bypass and necessitating postoperative mechanical ventilation between May 2016 and June 2021. Exclusion criteria included patients admitted to the ICU more than 7 days before surgery, those mechanically ventilated before surgery, and individuals who underwent multiple surgical procedures during the same ventilation episode (Supplemental Digital Content 1, S1.2 Study Population, http://links.lww.com/AA/F483).

Outcome

The outcome was the duration of mechanical ventilation, measured in minutes from ICU admission after surgery until extubation.

Exposure

The primary exposure was the use of dexmedetomidine infusion during mechanical ventilation within the first 7 days of the ICU stay, analyzed as a binary variable (use vs no use). We used the Sedation Burden Index (SBI) as the secondary exposure to examine average, total sedative dose patients received during mechanical ventilation (propofol, dexmedetomidine, fentanyl, hydromorphone, morphine, and midazolam). Sedatives given to extubated or reintubated patients were not considered. Total Sedation Burden Index was dichotomized into high and low exposure groups based on the median value (high Sedation Burden Index >.74), to allow for a straightforward comparison and to evaluate whether dexmedetomidine has greater clinical value in patients receiving higher sedative exposure.

The Sedation Burden Index is defined as $\mathrm{SBI} = \sum \frac{D}{d+D}$ where D is the administered drug dose, and d is a minimum effective hourly dose. The minimum effective dose is listed in Supplemental Digital Content 1, Table S2, http://links.lww.com/AA/F483. Consider, a 68-year-old patient weighing 75 kg, admitted to ICU, after a CABG procedure, who was mechanically ventilated for 49.4 hours. This patient, during mechanical ventilation, received a total of 2320.8 mcg of dexmedetomidine over 47.4 hours, propofol 3559.1mg over 47.1 hours and fentanyl 2360.6 mcg over 40.9 hours. Below are the steps used for the calculation of SBI for this patient:

1. Calculate average dose for each drug:

$$\text{Dexmedetomidine } \frac{2320.8\,\mu g}{75\,kg \quad X \quad 47.4\,h} = 0.7\ \mu g \cdot kg^{-1} \cdot h^{-1}$$

$$\text{Propofol } \frac{3559.1\,mg}{75\,kg \quad X \quad 47.1\,h} = 1.0\ mg \cdot kg^{-1} \cdot h^{-1}$$

$$\text{Fentanyl } \frac{2360.6\,\mu g}{75\,kg \quad X \quad 40.9\,h} = 0.8\ \mu g \cdot kg^{-1} \cdot h^{-1}$$

2. Calculate SBI for each drug ($\mathrm{SBI} = \sum \frac{D}{d+D}$ where D is the administered drug dose, and d is a minimum effective hourly dose):

Dexmedetomidine [$\mu g \cdot kg^{-1} \cdot h^{-1}$] $\frac{0.7}{0.2 \quad X \quad 0.7} = 0.8$

Propofol [$mg \cdot kg^{-1} \cdot h^{-1}$] $\frac{1.0}{0.3 \quad X \quad 1.0} = 0.8$

Fentanyl [$\mu g \cdot kg^{-1} \cdot h^{-1}$] $\frac{0.8}{0.7 \quad X \quad 0.8} = 0.5$

3. Calculate total SBI by summing the distinct SBIs for each sedative medication used:

SBI = 0. 8 + 0. 8 + 0. 5 = 2.1 (Supplemental Digital Content 1, Table S3 and S1.3 Variable Definitions, http://links.lww.com/AA/F483).

Covariates and Confounders

Potential confounders were identified and included in the model based on clinical judgment and evidence from the existing literature. Covariates were categorized into quintiles or clinically meaningful groups before being incorporated into the confounder model when a linear relationship with the outcome was not assumed (Supplemental Digital Content 1, Figure S1 and S2.1 Sensitivity Analysis, http://links.lww.com/AA/F483): Age (categorical), sex (female/male), duration of surgery (categorical), any packed red blood cells administered during surgery (Yes/No), total amount of crystalloids administered during surgery (categorical), duration of cardiopulmonary bypass (categorical), and Sequential Organ Failure Assessment (SOFA) score at ICU admission (categorical) (Supplemental Digital Content 1, Table S4, http://links.lww.com/AA/F483). Missing values for any component of the SOFA score were treated as within the normal range.

Sensitivity and Exploratory Analyses

We added inotropic support (dobutamine, epinephrine, or milrinone) given during the first 7 days of ICU stay to the confounder model. We also repeated the primary analysis after replacing the missing duration of cardiopulmonary bypass values with the cohort median. Furthermore, we repeated the primary analysis for the subgroup of patients who were extubated within 6 hours after the end of surgery. Additionally, we examined if the effect of dexmedetomidine was modified by type of cardiac surgery. With an exploratory intent, we analyzed the potential impact of a high proportion of delirious hours during mechanical ventilation on the primary association. (The delirium definition is outlined in Supplemental Digital Content 1, S1.3 Variable Definitions, http://links.lww.com/AA/F483).

Statistical Analysis

Multivariable linear regression was used to evaluate the associations between exposures and the outcome. For the analysis, we used a log-transformed outcome to account for the skewed distribution. Adjusted differences between groups in duration of mechanical ventilation were calculated using geometric means.[11,12] A listwise deletion approach was used to perform a complete-case analysis. We conducted an interaction analysis to determine whether the association between dexmedetomidine infusion and mechanical ventilation duration was modified by a high Sedation Burden Index. The interaction term was built as "dexmedetomidine x high Sedation Burden Index."

Categorical variables were presented as frequency and column percentage. Continuous variables were summarized as median (interquartile range, IQR) or mean ± standard deviation (SD). All statistical analyses were performed using Stata version 17 (StataCorp LLC). Graphics were prepared using GraphPad Prism version 10.0 (GraphPad Software).

RESULTS

Study Population

The study included 2269 patients; 78 patients were excluded due to prolonged preoperative ICU stays, preoperative mechanical ventilation, or undergoing multiple surgeries during the same ventilation episode. Thus, the final cohort consisted of 2191 patients. (Figure 1) Within this cohort, 1455 (66.4%) patients underwent coronary artery bypass graft (CABG) surgeries, 521 (23.8%) underwent valve surgeries, and 215 (9.8%) underwent combined CABG and valve surgeries. The mean ± SD age of the cohort was 64.3 ± 10.8, and 33.3% were female. Patients undergoing valve or combined CABG-valve procedures were more likely to be female (43.9% vs 27.9%), had a longer duration of cardiopulmonary bypass (122.1 ± 42.6 vs 92.7 ± 29.6 minutes), but the duration of surgery was not longer compared to patients undergoing CABG-only procedures.

Dexmedetomidine infusion was administered to 1659 patients (75.7%), with the median (IQR) dose of dexmedetomidine 0.5 $\mu g \cdot kg^{-1} \cdot h^{-1}$ (0.3–0.6). There was similar use of dexmedetomidine across surgery types: 1126 (77.4%) of CABG patients, 366 (70.3%) of valve surgery patients, and 167 (77.7%) combined CABG and valve surgery patients. Among patients who did not receive dexmedetomidine, the most commonly administered sedative drug was fentanyl (71.6%), followed by hydromorphone (14.5%), propofol (13.9%), and midazolam (1.3%). In the dexmedetomidine group, fentanyl was the most commonly coadministered sedative drug (74.0%), followed by hydromorphone (11.2%), propofol (9.3%), and midazolam (1.3%). Detailed patient and surgery characteristics, as well as information on sedatives administered during the ICU stay, are presented in Table 1 and Table S5, http://links.lww.com/AA/F483.

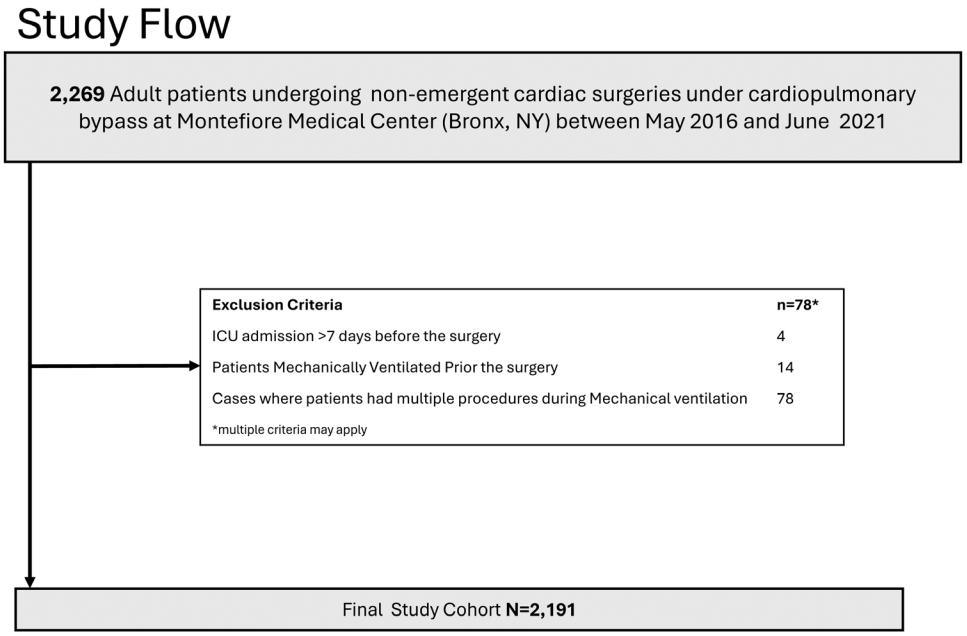
Study Flow
2,269 Adult patients undergoing non-emergent cardiac surgeries under cardiopulmonary bypass at Montefiore Medical Center (Bronx, NY) between May 2016 and June 2021
Exclusion Criteria
n=78*
ICU admission >7 days before the surgery
4
Patients Mechanically Ventilated Prior the surgery
14
Cases where patients had multiple procedures during Mechanical ventilation
78
*multiple criteria may apply
Final Study Cohort N=2,191

Figure 1. Study flow. ICU indicates intensive care unit; NY, New York.

Association of Dexmedetomidine Administration and Duration of Mechanical Ventilation

The median (IQR) duration of mechanical ventilation was 382 minutes (276–737) in patients without dexmedetomidine infusion and 419 minutes (302–863) in those who received dexmedetomidine infusion during their ICU stay. After adjusting for confounding variables, dexmedetomidine infusion was associated with a prolonged duration of mechanical ventilation, with an adjusted absolute difference (ADadj) of 42 minutes (95% CI, 11–75; MEadj 1.1; 95% CI, 1.0–1.2; $P = .007$; Table 2).

In the sensitivity analysis, the primary findings remained robust even after the inclusion of additional confounders (MEadj 1.1; 95% CI, 1.0–1.2; $P = .008$). In the subgroup analysis of those patients who were extubated within 6 hours of ICU admission (n=884, 40.3% of all patients in the study cohort), 652 (73.7%) received dexmedetomidine during mechanical ventilation. In these patients, dexmedetomidine compared with no dexmedetomidine was similarly associated with longer duration of mechanical ventilation (ADadj 18; 95% CI: 9–28; MEadj 1.1; 95% CI, 1.0–1.1; $P < .001$).

Missing Data

In the analysis, 1 observation was missing for body mass index, and 69 observations were missing for cardiopulmonary bypass duration. The unique association between dexmedetomidine administration and the duration of mechanical ventilation remained robust after replacing the missing duration of cardiopulmonary bypass values with the cohort median. (MEadj 1.1; 95% CI, 1.0–1.2; $P = .002$).

Association of Sedation Burden Index and Duration of Mechanical Ventilation

Patients with a high Sedation Burden Index experienced significantly longer ventilation compared to those with a low Sedation Burden Index. The ADadj was 71 minutes (95% CI, 42–101, MEadj 1.2; 95% CI, 1.1–1.2; $P < .001$; Table 2).

Interaction Analysis

We observed a significant effect modification of the association of dexmedetomidine and duration of mechanical ventilation by the Sedation Burden Index (P for interaction <.001, Figure 2). Among patients with a high Sedation Burden Index, dexmedetomidine administration was associated with a significantly shorter duration of mechanical ventilation (ADadj −233 minutes; 95% CI, −324 to −125; MEadj 0.7; 95% CI, 0.6–0.8; $P < .001$; Figure 2).

Similarly, a significant interaction was identified between dexmedetomidine use and the type of surgery performed (P for interaction =.003; Figure 2). Among patients undergoing valve surgeries or combined CABG and valve procedures, dexmedetomidine administration was associated with a longer duration of mechanical ventilation, (ADadj 99 minutes; 95% CI, 48–156; MEadj 1.2; 95% CI, 1.1–1.4; $P < .001$; Figure 2).

No significant interaction was observed between dexmedetomidine administration and high proportion of delirious hours during mechanical ventilation (Figure 2)

DISCUSSION

Dexmedetomidine administration was associated with a longer duration of postoperative mechanical

Table 1. Baseline Characteristics of Patients Undergoing Nonemergency Cardiac Surgeries Under Cardiopulmonary Bypass Between May 2016 and June 2021, Grouped By Dexmedetomidine and No Dexmedetomidine Infusion

Characteristic	No dexmedetomidine infusion	Dexmedetomidine infusion
Demographics	N = 532	N = 1659
Age (y)	64. 4 ± 11.4	64. 2 ± 10.6
Female sex	183 (34.4%)	546 (32.9%)
Body mass index (kg/m^2)	28.5 (25.0–32.5)	28.6 (25.3–32.7)
Surgery type		
CABG	329 (61.8%)	1126 (67.9%)
Valves	155 (29.1%)	366 (22.1%)
CABG with valves	48 (9.0%)	167 (10.1%)
Surgical approach		
Conventional	518 (97.4%)	1637 (98.7%)
Robotic	14 (2.6%)	22 (1.3%)
Duration of surgery (min)	411 ± 88	424 ± 85
Duration of cardiopulmonary bypass (min)	108 ± 39	101 ± 37
Intraoperative IV fluids (mL)	1379 ± 1002	1480 ± 986
Intraoperative administration of pRBC (units)	0.3 ± 0.7	0.3 ± 0.7
Fentanyl administration during ICU stay	381 (71.6%)	1228 (74.0%)
Propofol administration during ICU stay	74 (13.9%)	155 (9.3%)
Hydromorphone administration during ICU stay	77 (14.5%)	185 (11.2%)
Midazolam administration during ICU stay	7 (1.3%)	22 (1.3%)
SOFA score	6.0 (4.0–9.0)	7.0 (5.0–9.0)

Data are presented as mean ± SD or median (IQR) for continuous measures, and n (%) for categorical variables.

Abbreviations: CABG, coronary artery bypass graft; ICU, intensive care unit; IMV, invasive mechanical ventilation; IQR, interquartile range; pRBC, packed red blood cell; SOFA, sequential organ failure assessment.

ventilation in patients undergoing nonemergent on-pump cardiac surgery. Average, total sedative dose, quantified by Sedation Burden Index, was associated with longer duration of mechanical ventilation. In patients with a high sedation burden, dexmedetomidine administration was associated with a shorter duration of mechanical ventilation.

We found that dexmedetomidine infusion is associated with a longer duration of mechanical ventilation. Dexmedetomidine's relatively slow onset and long context-sensitive half-life, compared to propofol,[6] may explain the prolonged ventilation duration. The predominant use of the shorter-acting propofol in the non-dexmedetomidine group likely contributed to this difference. Although a 2024 joint consensus statement by the Enhanced Recovery After Surgery (ERAS) Cardiac Society, ERAS International Society, and The Society of Thoracic Surgeons (STS) supports early postoperative extubation within 6 hours and recommends dexmedetomidine as a part of multimodal analgesia in cardiac surgical patients,[13] our results suggest that dexmedetomidine has negative effects on early extubation, particularly in patients who undergo more complex cardiac surgical procedures and those who do not require high doses of sedatives.

In the primary analysis, we observed a significant association between dexmedetomidine and duration of mechanical ventilation across the entire study population. In the interaction analysis, we identified a significant effect modification between dexmedetomidine and type of surgery, with the effects of dexmedetomidine being magnified in patients who underwent valve surgery or combination of valve and CABG surgeries compared with patients who underwent CABG alone. Of note, despite the effect modification, the mechanical ventilation duration in patients who received dexmedetomidine was numerically longer across all procedure groups, including CABG surgery. The reasons for this effect are unclear but may reflect augmentation in sicker patients of the well-established negative effects of dexmedetomidine, namely bradycardia, hypotension, and, in the setting of stunned myocardium, reduced cardiac output.[14] This is consistent with recent expert consensus calls for caution in use of dexmedetomidine after cardiac surgery.[15]

Our secondary analysis revealed that a higher Sedation Burden Index was independently associated with longer mechanical ventilation, which supports

Table 2. Association of Duration of Mechanical Ventilation With Different Exposure Groups

Exposure group	N (%)	Duration of IMV minutes median (IQR)	ME 95% CI, *P* value	MEadj 95% CI, *P* value	ADadj in minutes 95% CI
No dexmedetomidine infusion	532 (24.3%)	382 (276–737)	1.1 (1.1–1.2),	1.1 (1.0–1.2),	42 (11–75)
Dexmedetomidine infusion	1659 (75.7%)	419 (302–863)	*P* < .001	*P* = .007	
Low Sedation Burden Index	1095 (50.0%)	391 (291–730)	1.2 (1.1–1.3),	1.2 (1.1–1.2),	71 (42–101)
High Sedation Burden Index	1096 (50.0%)	427 (304 – 966)	*P* < .001	*P* < .001	

Results of primary and secondary analyses are presented. Unadjusted and adjusted model estimates are presented with 95% CIs and *P*-values. Adjusted mean difference in IMV duration was calculated by using the geometric means of duration of IMV across the groups and the coefficients obtained from the multivariable regression model. The table includes the association of dexmedetomidine infusion and Sedation Burden Index compared to their respective reference groups (no dexmedetomidine infusion and low Sedation Burden Index).

Data are expressed as frequency (prevalence in %) or median (interquartile range).

Abbreviations: AD, absolute difference; Adj, adjusted; CI, confidence interval; IMV, invasive mechanical ventilation; IQR, interquartile range; ME, model estimate.

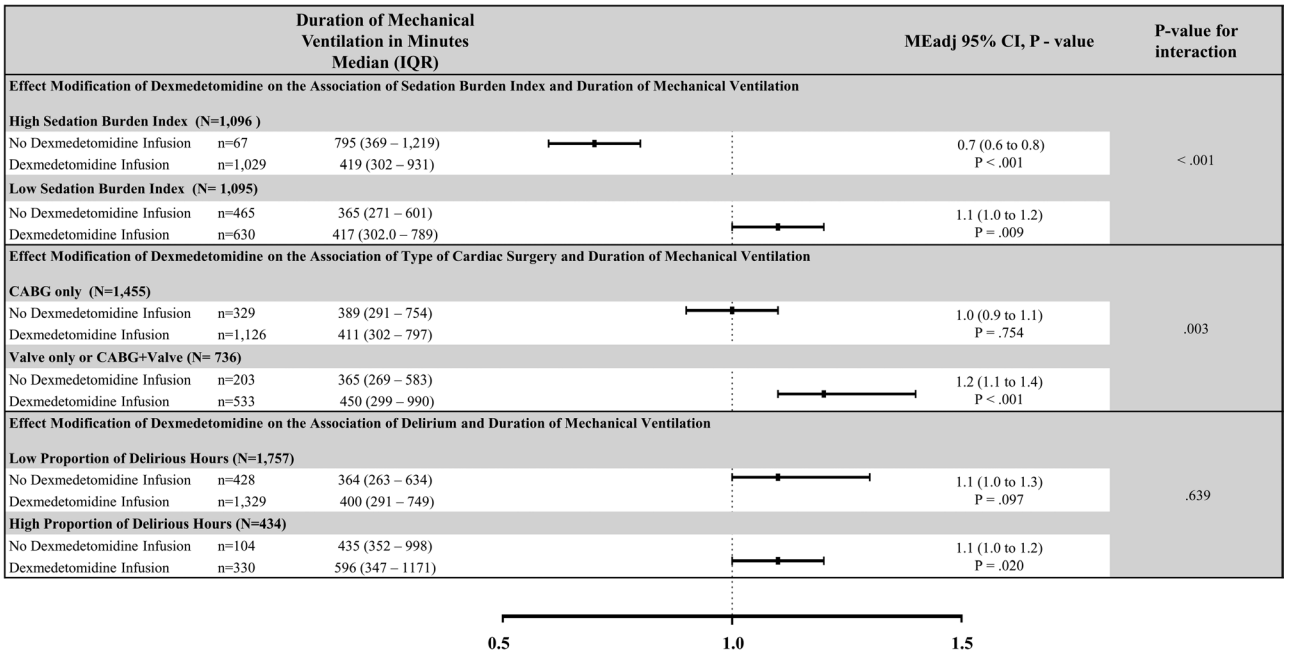
Duration of Mechanical Ventilation in Minutes Median (IQR)
MEadj 95% CI, P - value
P-value for interaction
Effect Modification of Dexmedetomidine on the Association of Sedation Burden Index and Duration of Mechanical Ventilation
High Sedation Burden Index (N=1,096)
No Dexmedetomidine Infusion n=67 795 (369 – 1,219)
Dexmedetomidine Infusion n=1,029 419 (302 – 931)
0.7 (0.6 to 0.8) P < .001
< .001
Low Sedation Burden Index (N= 1,095)
No Dexmedetomidine Infusion n=465 365 (271 – 601)
Dexmedetomidine Infusion n=630 417 (302.0 – 789)
1.1 (1.0 to 1.2) P = .009
Effect Modification of Dexmedetomidine on the Association of Type of Cardiac Surgery and Duration of Mechanical Ventilation
CABG only (N=1,455)
No Dexmedetomidine Infusion n=329 389 (291 – 754)
Dexmedetomidine Infusion n=1,126 411 (302 – 797)
1.0 (0.9 to 1.1) P = .754
.003
Valve only or CABG+Valve (N= 736)
No Dexmedetomidine Infusion n=203 365 (269 – 583)
Dexmedetomidine Infusion n=533 450 (299 – 990)
1.2 (1.1 to 1.4) P < .001
Effect Modification of Dexmedetomidine on the Association of Delirium and Duration of Mechanical Ventilation
Low Proportion of Delirious Hours (N=1,757)
No Dexmedetomidine Infusion n=428 364 (263 – 634)
Dexmedetomidine Infusion n=1,329 400 (291 – 749)
1.1 (1.0 to 1.3) P = .097
.639
High Proportion of Delirious Hours (N=434)
No Dexmedetomidine Infusion n=104 435 (352 – 998)
Dexmedetomidine Infusion n=330 596 (347 – 1171)
1.1 (1.0 to 1.2) P = .020
0.5
1.0
1.5

Figure 2. Association of dexmedetomidine infusion with mechanical ventilation duration and interaction with Sedation Burden Index, type of cardiac surgery, and proportion of delirium. Effect modifications are illustrated between dexmedetomidine infusion and high Sedation Burden Index, types of surgery (CABG versus valve/combined valve and CABG), and proportion of delirious hours. Statistical analyses were performed using log-transformed multivariable linear regression. Interaction terms were built as "exposure × interaction variable." Analyses were adjusted for age, sex, surgery duration, duration of cardiopulmonary bypass time, number of packed red blood cells transfused intraoperatively, intraoperative intravenous fluids, and sequential organ failure assessment score. Data are expressed as frequency or median (IQR). CABG indicates coronary artery bypass graft; CI, confidence interval; IMV, invasive mechanical ventilation; MEadj, adjusted model estimate.

previous reports.[16–19] A higher, average, total sedative dose also includes boluses of sedatives and analgesics in addition to infusions. In accordance, the SPICE III trial reported that 74.5% of ICU patients required adjunctive sedatives alongside dexmedetomidine to maintain targeted sedation levels.[20]

In our study, patients who received a high average total sedative dose (Sedation Burden Index) had shorter times to extubation when dexmedetomidine was given. This suggests that dexmedetomidine may confer benefits in the context of high sedative burden, potentially facilitating quicker weaning from mechanical ventilation.[9] Similar to our findings, Dasta et al reported that adding dexmedetomidine to midazolam or propofol-based sedation was associated with reduced ventilation time, though they did not specifically quantify sedative dose administered during ICU stay.[21]

Prior studies have identified delirium as a contributing factor to delayed extubation,[22–24] and it has been reported that patients who are agitated in the ICU often do better with alpha agonist drugs which are being explored for the treatment of delirium in the ICU.[25,26] Moreover, it is possible that dexmedetomidine, a drug with less respiratory depressant effects than opioids or propofol, helps preserve adequate spontaneous breathing under the conditions of high sedative requirements, a speculation that should be examined in future studies.

Limitations

Although we used robust statistical methods and adjusted for key confounders, residual confounding from unmeasured or unknown variables cannot be ruled out. The single-center nature of this study, conducted at an urban quaternary care institution, may limit external validity of our findings, particularly in smaller hospitals or nonurban settings with varying resource availability, patient demographics, or sedation practices. Finally, as with any study leveraging electronic health record data, potential misclassification bias in exposure or outcome measurement cannot be entirely excluded. Prospective, multicenter studies are needed to validate these findings and explore the sensitive interplay between sedation strategies, surgical complexity, and patient outcomes.

CONCLUSIONS

While dexmedetomidine was associated with prolonged mechanical ventilation duration, it appears to be associated with faster extubation in patients with high cumulative sedative burden. These findings underscore that dexmedetomidine's effects are context-dependent, and influenced by average, total sedative dose given during mechanical ventilation.

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DISCLOSURES

Conflicts of Interest: M. Eikermann receives funding from the NIH (R01AG065554 and R01HL132887), and Merck & Co., which do not pertain to this manuscript. He holds 2 patents for acyclic cucurbituril for reversal of drugs of abuse and neuromuscular blocking agents (Patent numbers: 9956229 and 9469648). He is a member of the associated editorial board for the *British Journal of Anaesthesia*. No other authors declared Conflicts of Interest. **Funding:** None. **This manuscript was handled by:** Karsten Bartels, MD, PhD, MBA.

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